For official use

Technical Report Series

DISTRICT GROUNDWATER BROCHURE
NILGIRI DISTRICT, TAMIL NADU

A.SUBBURAJ, SCIENTIST-D

Government of India
Ministry of Water Resources

Central Ground Water Board

South Eastern Coastal Region
Chennai

April 2009

DISTRICT AT A GLANCE (NILGIRI DISTRICT)

S.NO	ITEMS	STATISTICS	
1.	**GENERAL INFORMATION**		
	i. Geographical area (Sq. Km)	2545	
	ii. Administrative Divisions As on (31-3-2007) Number of Taluks Number of Blocks Number of Villages	 04 04 55	
	iii. Population (As on 2001 Census) Total Population Male Population Female Population	 762141 378351 383790	
	iv. Average Annual Rainfall (mm) (1901 - 1950)	1920	
2.	**GEOMORPHOLOGY**		
	i. Major physiographic Units	Mountainous district divided in to Nilgiri plateau, Nilgiri - Wayanad Plateau, Sigur plateau and outer slopes facing the plain.	
	ii. Major Drainages	Moyar, Sigur, Kethar halla, Coonoor, Kundha, Pykara, and Kateri.	
3.	**LAND USE (Sq. Km)**		
	i. Forest area ii. Net area sown iii. Cultivable waste	1425.77 810.00 20.18	
4.	**MAJOR SOIL TYPES**	Lateritic soil, Red sandy soil, Red loam, Black soil, Alluvial and Colluvial soils.	
5	**AREA UNDER PRINCIPAL CROPS (2005-06)**	Tea Veg. & Fruits Coffee Spices Paddy	58563Ha (72%) 8082Ha (10%) 7940Ha (10%) 4556Ha (6%) 1430Ha(2%)
6.	**IRRIGATION BY DIFFERENT SOURCES**	Numbers	Area irrigated (Ha)
	i. Dug wells	770	534
	ii. Tube wells/ Bore wells	Nil	Nil
	iii. Tanks/Ponds	Nil	Nil
	iv. Canals	01	07
	v. Other Sources	NA	209
	vi. Net irrigated area	750 Ha	
	vii. Cross irrigated area	750 Ha	
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2007)**		
	i. No of dug wells	08	
	ii. No of piezometers Under Hydrology Project	01	

8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium, Colluvium, Laterite, Granites, Dolerites, Quartzite, Charnockite and Gneisses, Schists.	
9.	**HYDROGEOLOGY**		
	i. Major water bearing formations	Alluvium, Colluvium, Laterite, weathered, fractured and fissured Crystalline rocks.	
	ii. Pre- monsoon depth to water level (May-2006)	1.20 – 17.06 m bgl	
	iii. Post- monsoon depth to water level (Jan. 2007)	1.28 - 16.60 m bgl	
	iv. Long term water level trend in 10 years (1997-2006) in m/year	Rise (m/year)	Fall (m/year)
		Min. 0.1249 Max. 0.2327	Min. 0.0030 Max. 0.1213
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)**		
	i. Number of Exploratory wells drilled ii. Number of Observation wells drilled iii. Number of Piezometers drilled under Hydrology Project	Nil Nil Nil	
11.	**GROUND WATER QUALITY**		
	i. Presence of chemical constituents more than permissible limit	Nil	
	ii. Type of water	HCO_3	
12.	**DYNAMIC GROUND WATER RESOURCES (31.03.2004) in M.Cu.m**		
	i. Annual Replenishable Ground Water Resources	116.39	
	ii. Net Annul Ground Water Draft	4.57	
	iii. Projected demand for Domestic and Industrial Uses up to 2025	3.53	
	iv. Stage of Ground Water Development (%)	7.5	
13.	**AWARENESS AND TRAINING ACTIVITY**	NIL	
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**		
	i. Projects completed by CGWB Number of structures Amount spent	Nil	
	ii. Projects under technical guidance of CGWB Number of structures	Nil	

15.	**GROUND WATER CONTROL AND REGULATION**	
	i. Number of OE Blocks	Nil
	ii. Number of Critical Blocks	Nil
	iii. Number of Blocks Notified	Nil
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUSES**	1) The limited saturation thickness in the weathered residuum has resulted in drying up of shallow wells in the local pockets. 2) The spring sources at many locations form a source for domestic water supply and they are not sustainable in peak summer and they go dry. 3) The dumping of waste materials in the surface water bodies have resulted in the pollution and it indirectly affects the groundwater system.

1.0 INTRODUCTION

1.1. Administrative Details

Nilgiri district is divided into 4 blocks, which are further divided into 55 revenue villages. Details of administrative set-up are given below.

S.No	Taluk	Block	Area (Sq.km)	No.of Villages
1	Udhagamandalam	Udhagamandalam	119764	20
2	Coonoor	Coonoor	22884	08
3	Kothagiri	Kothagiri	39665	15
4	Gudalur	Gudalur	72172	12
	District Total		**254485**	**55**

1.2. Basin and sub-basin

The district is falling in part of east flowing Cauvery river basin as per the Irrigation Atlas of India. Moyar, Bhavani, Kethar halla are the important sub basins.

1.3 Drainage

The Nilgiri district is drained by a number of streams originating from various peaks in the district. Moyar river flows in an easterly direction and is bordering the northern boundary of the district. Sigur and Pykara are the major streams of Moyar river.

The Bhavani river originates in Bhavaniar Betta and flows southwest ward and swings southwards. The Khunda river drains southern part of the district which joins Bhavani river in the south. The Katteri is another stream, which flows eastwards and joins the Bhavani river.

The river Kethar halla is flowing in the northern direction. Most of the rivers in Nilgiri plateau have been harnessed by drawing them at several points under the Kundha, Mukurthi, Pykara, Chalatti, Puzhe and Moyar Hydro- electric schemes.

1.4.Irrigation practices

The nine - fold land use classification for the district is given below (2005 - 2006)

Sl.No	Classification	Hectares
1	Forests	142577
2	Barren & Uncultivable Lands	3375
3	Land put to non- agricultural uses	9975
4	Cultivable Waste	2018
5	Permanent Pastures & other grazing lands	5078
6	Groves not included in the area sown	3538
7	Current Fallows	5069
8	Other Fallow Lands	1855
9	Net Area sown	81000
	Total	**254485**

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

The block wise and source wise net area irrigated in Ha is given below (2005-06).

S.No	Block	Net area irrigated by					Net Area irrigated
		Canals	Tanks	Tube wells	Ordinary wells	Other Sources	
1	Coonoor	0.00	0.00	0.00	434.00	68.00	502.00
2	Gudalur	0.00	0.00	0.00	98.00	140.00	238.00
3	Kothagiri	7.00	0.00	0.00	2.00	0.00	9.00
4	Udhagamandalam	0.00	0.00	0.00	0.00	1.00	1.00
District Total		**7.00**	**0.00**	**0.00**	**534.00**	**209.00**	**750.00**

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

A perusal of the table shows that an area of about 750 ha, which is about 0.30 percent of the total geographical area of the district is irrigated. Dug wells are the major source of water for irrigation in the district, accounting for about 71% of the total area irrigated in the district. Other sources and canals account for about 28% and 1% respectively. It is observed that the well irrigation is the highest in Coonoor block followed by Gudalur block.

1.5 Studies/Activities carried out by CGWB

CGWB has carrying out systematic Hydrogeological surveys were carried out during 1987-89. A few water supply investigations were carried out in 1982 & 1983. CGWB is monitoring the groundwater regime for the changes in water level and water quality through 8 dug wells and 1 piezometer. The monitoring of water levels is carried out during May (Pre monsoon), August (Middle of south west monsoon), November (post south west monsoon & initial stage of north east monsoon) & January (Post North east monsoon) to study the impact of rainfall on groundwater regime. Water samples are collected during May for determining the changes in chemical quality of groundwater.

2.0 RAINFALLS AND CLIMATE

The district receives rainfall both in southwest and northeast monsoons. The southwest monsoon is more active contributing nearly 50 percent in the western part of the district and 40 percent in the eastern part of the district. The northeast monsoon is moderate, contributing nearly 40 percent. The precipitation of rainfall gradually decreases from west to east. The rains during the winter and summer periods are significant.

Rainfall data from four stations over the period 1901-1950 were utilized for analysis and a perusal of the analysis shows that the normal annual rainfall of the district is 1920 mm. It is minimum around Udhagamandalam (1376.20 mm) in the eastern part of the district. It gradually increases towards west and attains a maximum around Gudalur (2269 mm).

The climate of Nilgiri district is temperate and salubrious throughout the year. Mornings in general, are more humid than the afternoons, with the humidity exceeding 90%. In the period June to November the afternoon humidity exceeds 85 %

on an average. In the rest of the year the afternoons are low, the summer afternoons being the lowest. The day temperature in the district ranges from 22.1°C in summer to 5.1°C in winter.

3.0. GEOMORPHOLOGY AND SOIL TYPES

3.1. Geomorphology

Nilgiri district is a mountainous district of Tamil Nadu with many hill ranges and broad valleys. The Nilgiri hills rise abruptly from the plains (300 m. above MSL) to an average elevation of 1370 m above MSL. Some of the prominent peaks are the Dodda Betta (2632 m), Kolari (2625 m), Mukurthi (2554 m), Kudikadu (2590.m), and Deva Betta (2552 m), the conical grass covered Der Betta and Bear hill (2531 m) and Nilgiri peak.

The prominent geomorphic units identified in the district through interpretation of Satellite imagery are 1) Structural hills, 2) Ridges, 3) Valley fills, 4) Pediments, 5) Shallow Pediments, 6) Deep Pediments 7) Hill top valley 8) Erosional plains.

3.2 Soils

The soils of Nilgiri district can be broadly classified into 5 major soils types viz., Lateritic soil, Red sandy soil, Red loam, Black soil, Alluvial and Colluvial soil. Major part of the district is covered by Lateritic soil. The Red sandy soil and Red loams occur as small patches. Black soil is developed in the valleys, while alluvial and colluvial soils are seen along the Valleys and major river courses respectively.

4.0. GROUND WATER SCENARIO

4.1. Hydrogeology

Nilgiri district is underlain entirely by Archaean Crystalline formations with Recent alluvial and colluvial deposits along the river courses and foothills. The occurrence and movement of ground water are controlled by various factors such as physiography, climate, geology and structural features etc. Weathered and fractured crystalline rocks, alluvial and colluvial formations constitute the important aquifer systems in the district.

The porous formations in the district are represented by alluvium and colluvium. The alluvial deposits comprising sand with admixtures of silt and clay are confined to the major river and stream courses only. It has been reported that the wells tapping river alluvium remain dry during drought years and in the year of less rainfall. The colluvial materials comprising the sands and gravels are seen in the valley portions. Ground water is developed by dug wells and occurs under phreatic conditions. The depth range of these shallow aquifers is from 5 to 20 m bgl.

Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The thickness of the weathered mantle is varying from less than a meter to as much as 15 m. The depth of the wells ranged from 5 to 25m bgl. The weathered mantle followed by the jointed and

fractured rocks constitute the shallow water table aquifer and it occurs in the major part of the district with in the depth of 20 – 25 m bgl in general.

The Specific capacity of large diameter wells tested in crystalline rocks varying from 100 to 200 lpm / m of draw down. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering.

The yield of bore wells drilled down to a depth of 45 to 100 m, by various state agencies mainly for domestic purposes yielded up to 1 lps and can sustain up to 2 – 4 hours a day.

The groundwater in the hilly terrain often flows out as springs, when the watertable cuts across the land surface. The springs are seasonal and perennial depending on the depth to water level and its relation to ground surface. In Nilgiri District also, the phenomenon of springs is quite common and are mostly seasonal, which goes dry during the peak summer.

The depth to water level in the district varied between 1.20 and 17.06 m bgl during pre-monsoon (May 2006) and it varied between 1.28 and 16.60 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level in the range of 0. 35 to 3.05 m and fall in the range 0.08 to 0.73 m. The piezometric head is 2.48 m bgl during pre monsoon (May 2006) and 2.94 m bgl during post monsoon (Jan 2007).

4.1.1 Long Term Fluctuation (1998-2007)

The long-term water level fluctuation for the period 1998-2007 indicates both rise and fall in different parts of the district. The rise in water level is of the order of 0.1249-0.2327 m/year, while the fall is of the order of 0.0030 to 0.1213 m/year.

4.1.2 Aquifer Parameters

The CGWB has not taken up the ground water exploration by drilling in the district. Govt of Tamil Nadu has drilled few bore wells with depth ranging from 45.00 to100.00 for drinking water purpose. The fractures are also encountered within 100m bgl.

Formation	Yield of wells (lps)	Transmissivity (m^2/day)	Specific yield (%)
Porous formation	1.0 - 4	50 - 250	3- 6
Weathered rock	< 1 – 2	<1 - 50	1.5
Fractured rock	<= 1	<1 - 10	-

4.1.3 Ground Water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground & Surface Water Resources and Data Center (PWD, WRO,

Government of Tamil Nadu) as on 31st March 2004, using GEC 1997 methodology and the salient features of the computations are furnished as a table.

4.3 Ground Water Quality

Ground water in phreatic aquifers in Nilgiri district is in general colorless, odorless and predominantly alkaline in nature. The specific electrical conductance of ground water in phreatic zone (in Micro Seimens at 25°C) during May 2006 was in the range of 116 to 700 in the district. In the major part of the district electrical conductivity is below 500 $\mu S/cm^{-1}$.

It is observed that in major part of the district, the ground water is suitable for drinking and domestic uses in respect of all the constituents. All the constituents are within the permissible limit of drinking water limits except nitrate exceeding the limit in 15 percent of the analyzed samples.

With regard to irrigation suitability based on specific electrical conductance and sodium Absorption Ratio (SAR), it is observed that groundwater in the phreatic zone is suitable for irrigation for all soil types. No salinity or alkali hazard is expected when ground water is used for irrigation purposes.

4.4 Status of Ground Water Development

The estimation of groundwater resources for the district has shown that all the 4 blocks are falling under Safe category. Tamil Nadu Water Supply and Drainage (TWAD) Board is the Government agency responsible for providing drinking water supplies to the urban and rural populace in the district. The water requirements of the habitations are met with either through surface water sources or through various Mini Water Supply Schemes or Integrated water supply schemes utilising the available ground water resources. The status of urban and rural water supply in the district as in March 2007 is furnished below.

Total Number of Rural Habitants	:	1034	
Not Covered	:	1	(0-9 LPCD)
Partly Covered	:	292	(10-39 LPCD)
Fully Covered	:	741	(40 LPCD and above)

The habitants of 4 Municipalities of the district are provided with 40 - 90 LPCD and the habitants of 11 town Panchayats are provided with 55 – 70 LPCD.

Dug wells have traditionally been the most common ground water abstraction structures used for irrigation in the district and can yield up to 50 –100 m^3/day in weathered crystalline rocks and up to 200 m^3/day in recent alluvial formations along major drainage courses.

Stage of Groundwater Development of Nilgiri District as on 31st March 2004 (Ham)

S.No	Block	Net Groundwater Availability	Existing Gross Draft for Irrigation	Existing Gross Draft for Domestic and industrial water supply	Existing Gross Draft for all uses	Allocation for Domestic and Industrial Requirement supply up to next 25 years (2029)	Net groundwater Availability for future Irrigation Development	Stage of Groundwater Development	Category
1	Coonoor	1839.36	0.00	84.93	84.93	87.94	1751.42	5	Safe
2	Gudalur	6308.76	62.46	98.63	161.10	102.13	6144.16	3	Safe
3	Kotagiri	2826.76	0.00	85.95	85.95	89.00	2737.76	3	Safe
4	Udhagamandalam	664.22	54.27	71.32	125.59	73.85	536.10	19	Safe
	District Total	**11639.10**	**116.74**	**340.83**	**457.57**	**352.93**	**11169.44**	**4**	

5.0 GROUNDWATER MANAGEMENT STRATEGY

5.1 Groundwater Development

In view of the comparatively low level of ground water development in the district, there is scope for further development. However, because of the hilly terrain of the district, the sites for groundwater exploitation will be favourable in valleys and local site conditions. Hence, detailed prior investigations are required to take up siting of wells.

The development of ground water for irrigation in the district is only through dug wells tapping the weathered residuum, colluvium or alluvium along the stream courses. Dug wells with extension bores wherever necessary is ideal for hard rock areas whereas large diameter dug wells with radials is suitable for alluvial and Colluvial areas.

5.2 Water Conservation and Artificial Recharge

The topography of Nilgiri district, in general, is suited for constructions of artificial recharge structures such as check dams and sub-surface dykes. The non-committed surplus run off available and the terrain condition will be the governing factor in selection of suitable structures. The exact locations of these structures, however, are to be decided on the basis of detailed field investigations.

There is considerable scope for implementation of roof – top rainwater harvesting in the district. Free technical guidance for implementation of rooftop rainwater harvesting schemes is also being provided by CGWB.

6.0 GROUNDWATER RELATED ISSUES & PROBLEMS

The limited saturation thickness in the weathered residuum has resulted in drying up of shallow wells in the local pockets.

The spring sources at many locations form a source for domestic water supply and they are not sustainable in peak summer and they go dry.

The dumping of waste materials in the surface water bodies have resulted in the pollution and it indirectly affects the groundwater system.

7.0 AWARENESS & TRAINING ACTIVITY

Nil

8.0 AREA NOTIFIED BY CGWA/SGWA

Neither Central Ground Water Authority nor State Ground Water Authority has notified any area in the district.

9.0 RECOMMENDATIONS

In view of the comparatively low level of ground water development in the district, there is scope for further development. However, because of the hilly terrain of the district, the sites for groundwater exploitation will be favourable in valleys and local site conditions. Hence, detailed prior investigations are required to take up siting of wells.

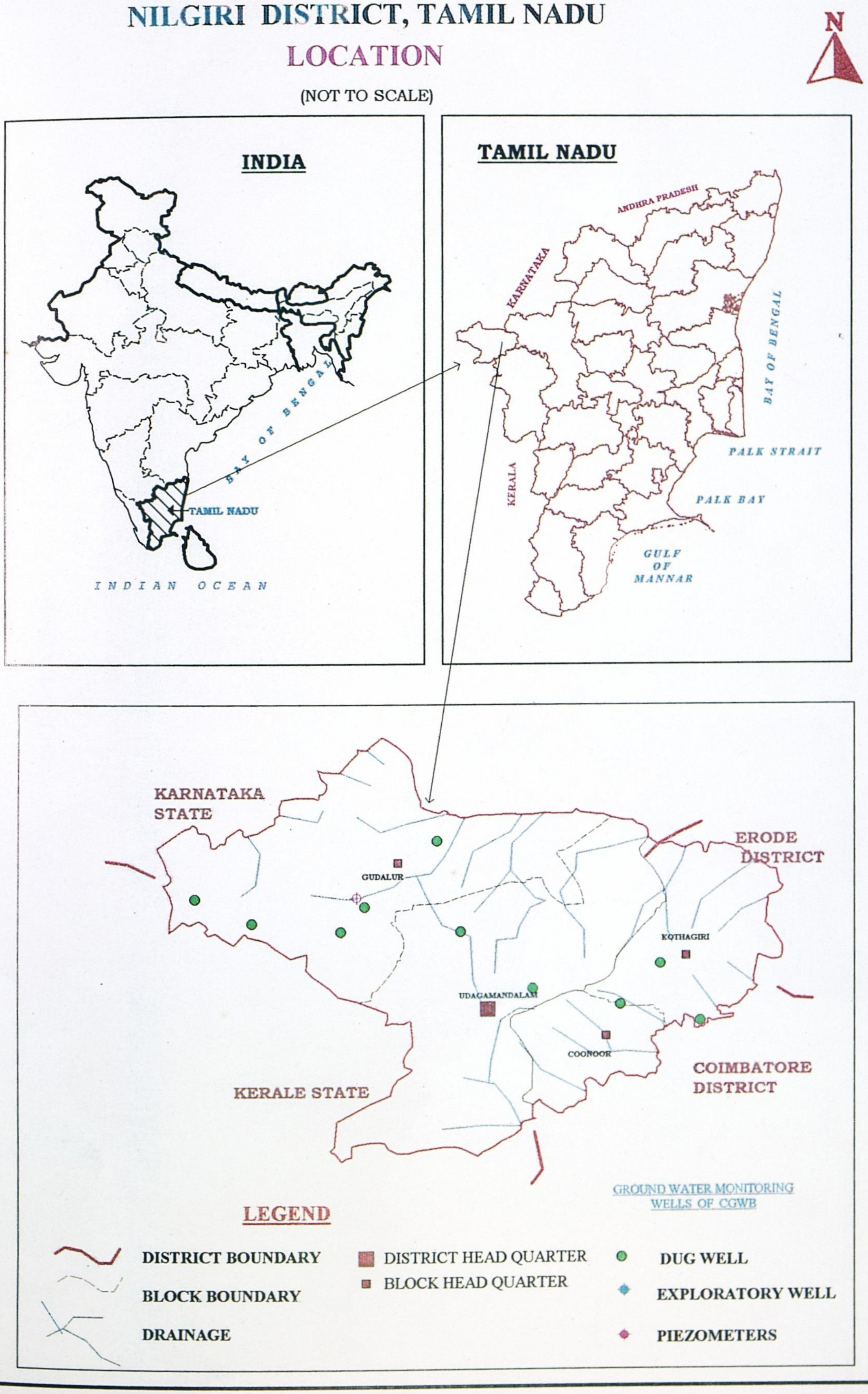
Artificial recharge of ground water through cost-effective rainwater harvesting systems may be popularized in the district by providing incentives to individuals/communities embarking upon such initiatives. A concerted effort involving various Government agencies and NGOs can create the necessary awareness among the rural masses.

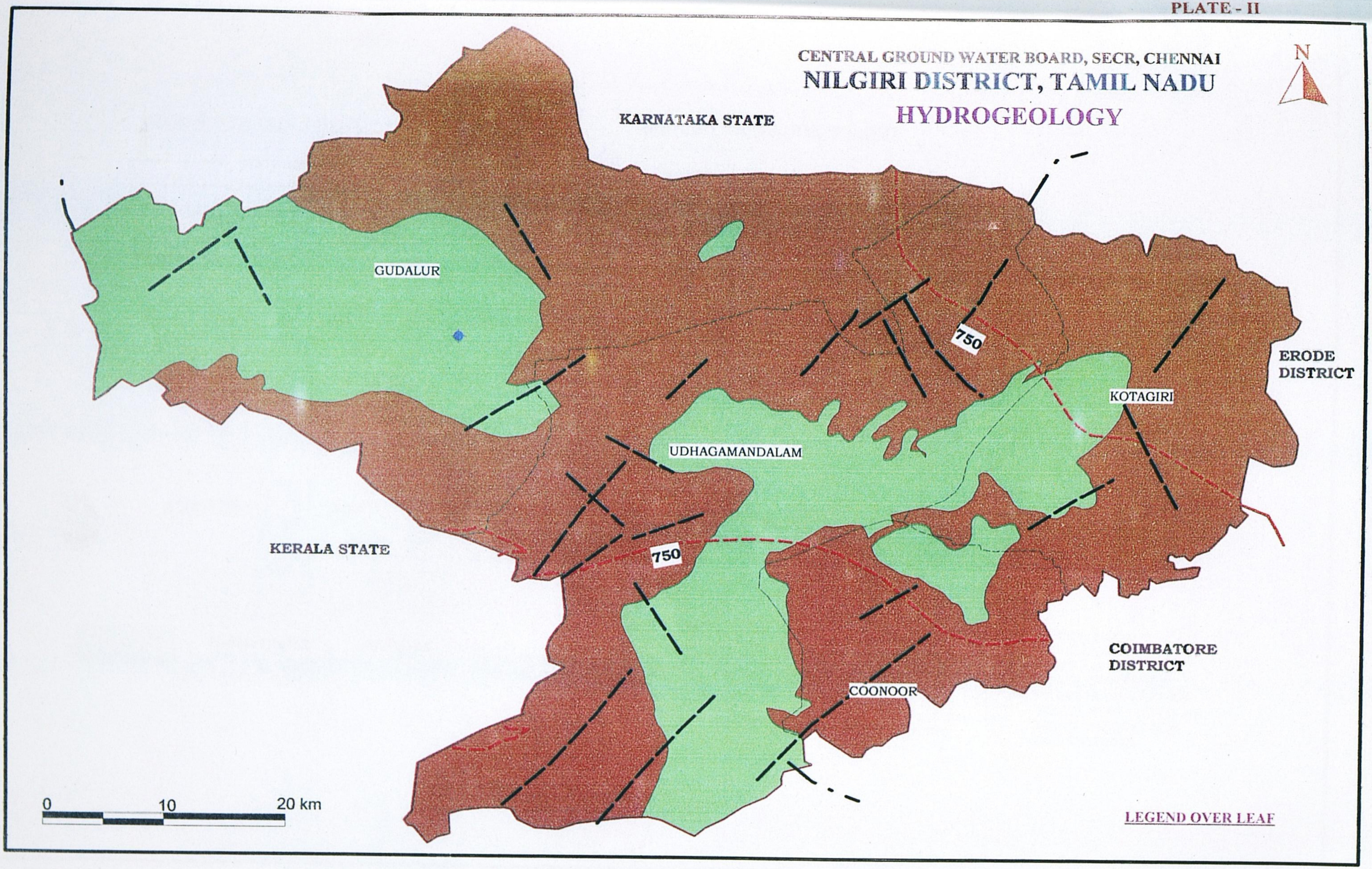
CENTRAL GROUND WATER BOARD, SECR, CHENNAI

NILGIRI DISTRICT, TAMIL NADU

LOCATION

(NOT TO SCALE)




CENTRAL GROUND WATER BOARD, SECR, CHENNAI
NILGIRI DISTRICT, TAMIL NADU
HYDROGEOLOGY
N
KARNATAKA STATE
GUDALUR
750
UDHAGAMANDALAM
KOTAGIRI
ERODE DISTRICT
KERALA STATE
750
COONOOR
COIMBATORE DISTRICT
0
10
20 km
LEGEND OVER LEAF

LEGEND FOR PLATE - II

ADMINISTRATIVE SETUP

- STATE BOUNDARY
- DISTRICT BOUNDARY
- BLOCK BOUNDARY
- HILLY AREA

GROUND WATER HYDROLOGY

- EXPLORATORY BORE WELL [CGWB]

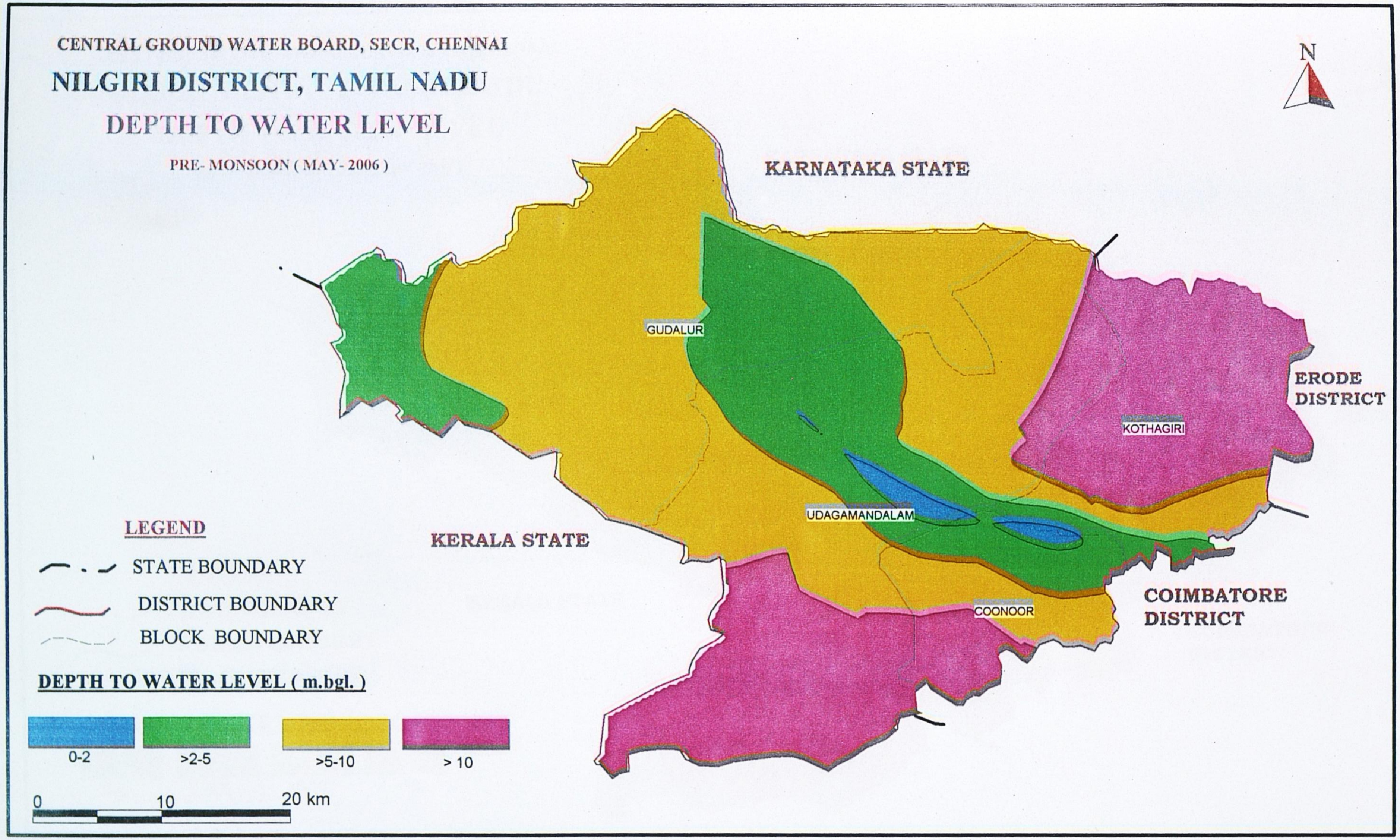
HYDROCHEMISTRY

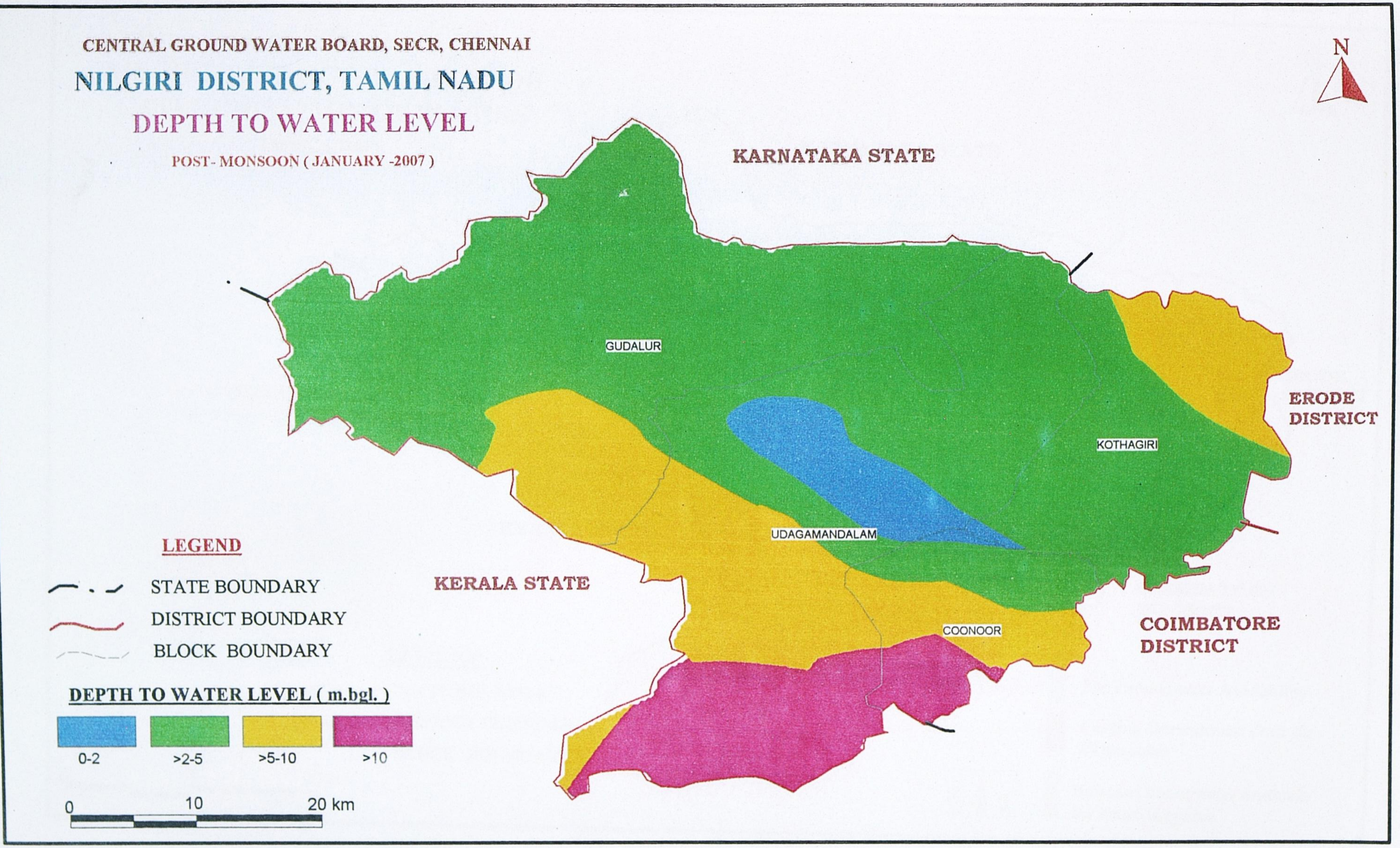
750 ISOCONS [Sp ELECTRICAL CONDUCTANCE [µs /Cm at 25° C]

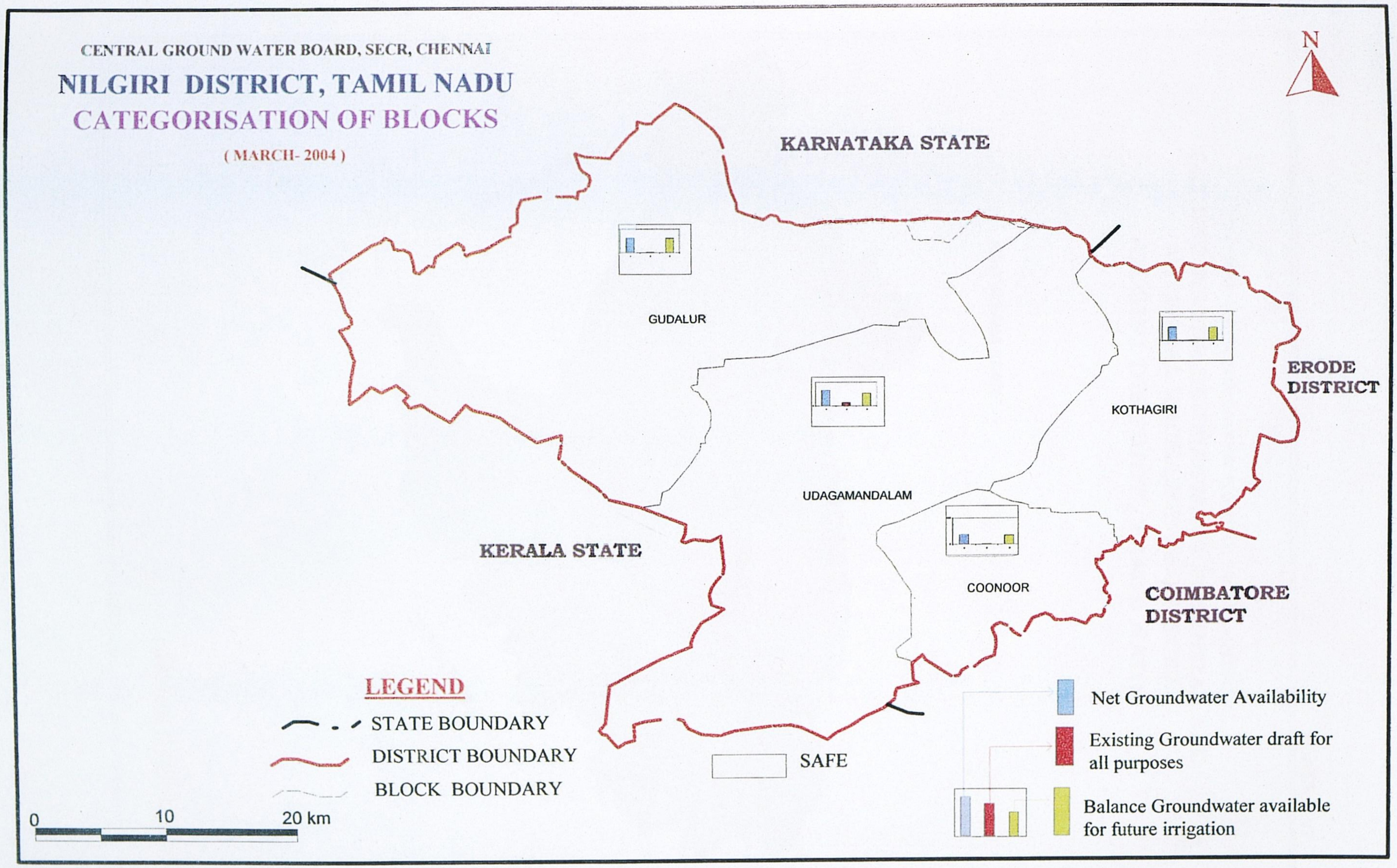
STRUCTURE

- TRACE OF LINEAMENT

AQUIFER	AGE	LITHOLOGY	GROUND WATER CONDITIONS	YIELD PROSPECTS (CU.M/D)	GROUND WATER DEVELOPMENT STRATEGIES
CONSOLIDATED	ARCHAEAN	GRANITES, GNEISSES, CHARNOCKITE.	DISCONTINUOUS, UNCONFINED TO SEMICONFINED AQUIFERS,RESTRICTED TO WEATHERED RESIDUUM AND FRACTURES	< 50 NEAR WATERSHED DIVIDES & HIGH GROUNDS. 50 - 200 NEAR THIRD ORDER STREAMS AND LOW GROUNDS.	SUITABLE FOR DEVELOPMENT THROUGH DUG WELLS.BOREWELLS FEASIBLE IN FRACTURE ZONES, BEST LOCATIONS BEING INTERSECTION OF FRACTURES


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
NILGIRI DISTRICT, TAMIL NADU
DEPTH TO WATER LEVEL
PRE- MONSOON (MAY- 2006)
N
KARNATAKA STATE
KERALA STATE
ERODE DISTRICT
COIMBATORE DISTRICT
GUDALUR
KOTHAGIRI
UDAGAMANDALAM
COONOOR
LEGEND
STATE BOUNDARY
DISTRICT BOUNDARY
BLOCK BOUNDARY
DEPTH TO WATER LEVEL (m.bgl.)
0-2
>2-5
>5-10
> 10
0
10
20 km


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
NILGIRI DISTRICT, TAMIL NADU
DEPTH TO WATER LEVEL
POST- MONSOON (JANUARY -2007)
N
KARNATAKA STATE
GUDALUR
KOTHAGIRI
UDAGAMANDALAM
COONOOR
ERODE DISTRICT
COIMBATORE DISTRICT
KERALA STATE
LEGEND
STATE BOUNDARY
DISTRICT BOUNDARY
BLOCK BOUNDARY
DEPTH TO WATER LEVEL (m.bgl.)
0-2
>2-5
>5-10
>10
0
10
20 km



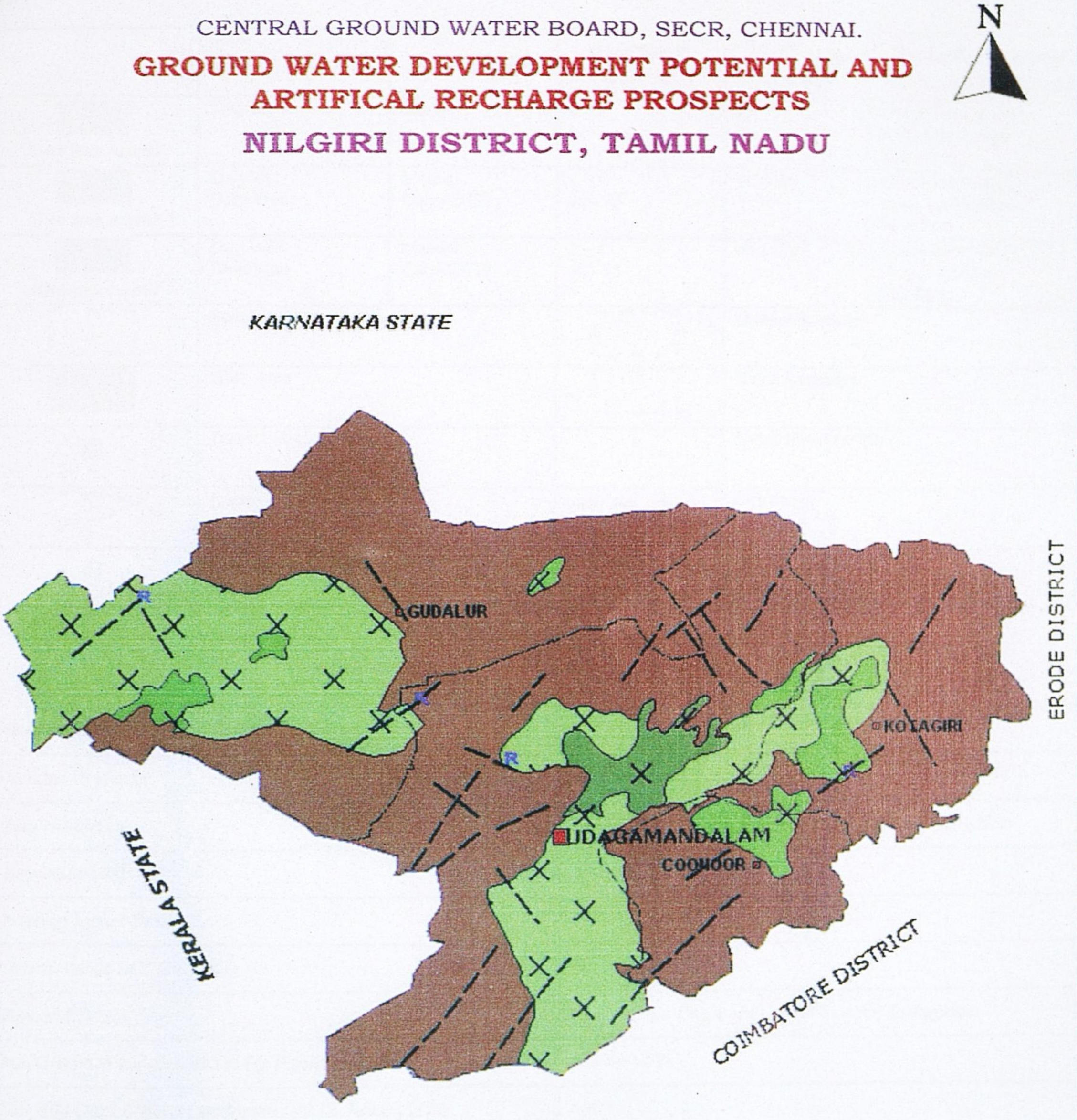
CENTRAL GROUND WATER BOARD, SECR, CHENNAI
NILGIRI DISTRICT, TAMIL NADU
CATEGORISATION OF BLOCKS
(MARCH- 2004)
N
KARNATAKA STATE
GUDALUR
UDAGAMANDALAM
KOTHAGIRI
COONOOR
ERODE DISTRICT
COIMBATORE DISTRICT
KERALA STATE
LEGEND
STATE BOUNDARY
DISTRICT BOUNDARY
BLOCK BOUNDARY
SAFE
Net Groundwater Availability
Existing Groundwater draft for all purposes
Balance Groundwater available for future irrigation
0
10
20 km

PLATE - VI

CENTRAL GROUND WATER BOARD, SECR, CHENNAI.

GROUND WATER DEVELOPMENT POTENTIAL AND ARTIFICAL RECHARGE PROSPECTS

NILGIRI DISTRICT, TAMIL NADU



LEGEND OVER LEAF

LEGEND FOR PLATE - VI

DISTRICT – NILGIRI

	Wells Feasible	Rigs Suitable	Depth Of Well (M)	Discharge (LPM)	Suitable Artificial Recharge Structures
Hard Rock Aquifer	Dug Well	Manual	6 – 8	20	Check Dam/ Gully Plugging/ Gabion Structures
Hard Rock Aquifer	Dug Well Bore Well	Manual Calyx\DTH	6 – 8 40 - 75	50 - 100	Check Dam/ Gully Plugging/ Gabion Structures
Hard Rock Aquifer	Dug Well Bore Well	Manual Calyx\DTH	5 – 8 40 - 75	60 - 120	Check Dam/ Gully Plugging/Gabion Structures
	State Boundary			District Boundary	
	Hilly Area			Block Boundary	
	District Headquarters			Block Headquarters	
	River			Lineament	
R	Recommended Site For Artificial Recharge Structure				

OTHER INFORMATION

Geographical Area	2545 Sq.Km
Number Of Blocks	4
Major Drainage	Moyar, Sigur, Pykara, Bhavani, Kundha, Kotagiri & Kallar
Population (2001)	7,62,141
Average Annual Rainfall	1920mm
Annual Range Of Temperature	9 - 22°C
Regional Geology	**Hard Rocks:** Charnockite, Biotite Gneiss & Magnetite
Net Ground Water Availability For Future Irrigation	112 MCM/Yr
Stage Of Ground Water Development As On January 2003	4 %
Names Of Blocks Showing Intensive Ground Water Development	Nil

SAVE WATER

AND

CONSERVE WATER

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rdsecr-cgwb@nic.in

SAVE WATER

AND

CONSERVE WATER

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